

the revised schedule or the current schedule as the new current schedule; and

instructions for selecting one of the revised schedules as the final schedule.

REMARKS

Claims 1-20 were filed and are pending. Claims 1-11 and 20 were rejected under 35 U.S.C. § 101. Claims 1-20 were rejected under 35 U.S.C. § 103. Claims 1, 12 and 20 have been amended. Reconsideration and allowance of Claims 1-20 is requested.

Rejection of Claims under 35 U.S.C. § 101

The Examiner rejected Claims 1-11 and 20 under 35 U.S.C. § 101.

Regarding claims 1-11, the Examiner stated:

[T]he disclosed invention is within the technological arts because there is a computer involved or described to perform the claimed functions as noted throughout applicant's specification. The claimed invention of claims 1-11 are also noted not to be a computer program, data structure, or a natural phenomenon. The claimed invention includes a series of steps not to be performed by a general purpose computer. The claimed invention also does not include a post-computer process activity or a pre-computer process activity. No physical transformation is performed, no practical application is found. Consequently, the claims are analyzed based upon the underlying process, and are thus rejected as being directed to a non-statutory process.

A claimed computer-related process is statutory if the process has a practical application within the technological arts. Claim 1 recites "[a] method for scheduling a complex activity that is governed by a set of pre-defined constraints

including consumable resource constraints, wherein an unacceptable schedule exists for the activity." Scheduling a complex activity is clearly a practical application within the technological arts of the steps of the method recited in Claim 1.

For example, Claim 1 recites steps of calculating a score for [a] schedule. Alone, it may be contended that such steps are non-statutory, as suggested by, for example, lines 5-7 of the second column of MPEP page 2100-16. However, Claim 1 further recites the step of "selecting one of [a] revised schedule or [a] current schedule as a new current schedule based upon a comparison of the score of the revised schedule and the score of the current schedule." The step of selecting is clearly a practical application within the technological arts of the steps of calculating a score and therefore the method recited in Claim 1 is statutory. Thus, a method as recited in Claim 1, which includes steps of calculating a score which may, by themselves, be non-statutory, appears to be analogous to the process described at lines 7-9 of the second column of MPEP page 2100-16 (which is deemed therein to be a statutory process), which makes use of the allegedly non-statutory process described at lines 5-7 (and discussed above).

Regarding claim 20, the Examiner stated:

[D]ata [s]tructures not claimed as embodied in computer-readable media are descriptive material per se and are not statutory because they are neither physical "things" nor statutory processes. Such claimed data structures do not define any structural and functional interrelationships between the data structure and other claimed aspects of the invention which permit the data structure's functionality to be realized. In contrast, a claimed computer-readable medium encoded with a data

structure defines structural and functional interrelationships between the data structure and the medium which permit the data structure's functionality to be realized, and is statutory. Thus, claim 20 is rejected as being non-statutory as described above.

Applicants are unclear as to the nature of the Examiner's rationale for concluding that Claim 20 recites non-statutory subject matter. As best Applicants can discern, the Examiner is contending that Claim 20 recites an unpatentable data structure. However, the Examiner stated that while "data [s]tructures not claimed as embodied in computer-readable media ... are not statutory," "a claimed computer-readable medium encoded with a data structure ... is statutory." Claim 20 recites "al computer readable medium encoded with one or more computer programs for enabling scheduling of a complex activity that is governed by a set of pre-defined constraints including consumable resource constraints" (emphasis added). Thus, assuming arguendo that Claim 20 recites a data structure, according to the Examiner's own reasoning, Claim 20 recites statutory subject matter. Applicants further note, as indicated by the above-quoted section of Claim 20, that Claim 20 does not recite a data structure, but, rather, computer programs for enabling scheduling of a complex activity.

Finally, Applicants question the propriety of raising a non-statutory subject matter rejection in the outstanding Office Action, which is the third Office Action issued for the subject matter of this application. In any event, as explained above, Claims 1-11 and 20 clearly recite statutory subject matter.

In view of the foregoing, it is requested that the rejection of Claims 1-11 and 20 under 35 U.S.C. § 101 be withdrawn.

Rejection of Claims under 35 U.S.C. § 103

The Examiner rejected Claims 1-20 under 35 U.S.C. § 103 as unpatentable over Syswerda in view of Tanaka.

In response to Applicants' remarks made in the Amendment dated January 17, 1997, in the parent application of this continuation application (hereinafter, the "previous Office Action response"), the Examiner stated:

[T]he applicant has traversed the first office action in this case on two fundamental grounds. First as asserted on page 9 in the applicant's response received February 6, 1997, neither Syswerda nor Tanaka teaches scheduling a task that uses consumable resources. Second, as asserted on page 12 in the applicant's response[,] Tanaka teaches constraint relaxation which is not the same as constraint repair as claimed. The Examiner respectfully disagrees on both issues.

Regarding Applicants' contention in the previous Office Action response that neither Syswerda nor Tanaka teaches scheduling an activity that uses consumable resources, the Examiner further stated:

Regarding the first issue both Syswerda and Tanaka are scheduling systems used in factory environments. Both systems allocate resources to tasks. In a factory, both reusable and consumable resources are applied to tasks in order to create a product. Syswerda specifically discusses the allocation of resources to tasks (see column 4, lines 12-19 of Syswerda). The applicant asserts that Syswerda only deals with reusable resources and cites column 4, lines 26-28 as support. However, the passage cited was an example of what is referred to by Syswerda as a hard constraint violation. Namely, a single task could only use a single given resource at any given time and any violation would be considered a violation of a hard constraint not permitted. The Syswerda invention

teaches the use of both hard and soft constraints with the distinction being that hard constraints may not be violated and soft constraints may be. Otherwise, the user may specify anything as being a hard or soft constraint and the Examiner asserts that this includes both reusable and consumable. As an example, the user of the Syswerda system may specify that inventory may not drop below a certain point and that this can be designated either a hard constraint or a soft constraint by the user. For example, if inventory may be easily and quickly replenished then this may be a soft constraint and relaxing the constraint [] using the Tanaka invention would be possible. On the other hand, if lead time for a part is long, then this could be designated a hard constraint.

Assuming arguendo that "both Syswerda and Tanaka are scheduling systems used in factory environments" and that "[i]n a factory, both reusable and consumable resources are applied to tasks in order to create a product," as stated by the Examiner, it does not necessarily follow that either Syswerda or Tanaka teach or suggest scheduling an activity that uses consumable resources, as recited in Applicants' claims. It can be the case that a scheduling system used in a factory environment is only used to schedule reusable resources, such as machinery or personnel.

The Examiner stated that "[t]he Syswerda invention teaches the use of both hard and soft constraints with the distinction being that hard constraints may not be violated and soft constraints may be" and "that this includes both reusable and consumable." The Examiner appears to be incorrectly equating hard and soft resource constraints with consumable and reusable resource constraints, then contending that since Syswerda teaches the use of hard and soft resource constraints, Syswerda teaches the use of consumable and reusable resource constraints. (If

not, the foregoing statements in the Office Action amount to a bald statement that Syswerda teaches the use of consumable and reusable resource constraints, which, as discussed elsewhere herein and in the previous Office Action response, is not the case.) Assuming arguendo that Syswerda teaches the use of hard and soft constraints, this does not indicate anything regarding whether or not Syswerda teaches or suggests the use of consumable and reusable resource constraints, since the latter are not equivalent to the former. As stated in Applicants' specification at page 50, line 21 to page 51, line 3:

[A]ll constraints can be classified along a continuum of "soft" to "hard" constraints. Soft constraints are constraints that are preferably not violated, but can be violated without introducing physically impossible situations into the schedule. The softest constraints are constraints for which a violation generates the least problem or concern regarding the violation. Violation of a soft constraint may simply result in a task being more costly than desired. Optimization constraints are an example of soft constraints. Another example is the "soft temporal constraint" discussed above. At the other end of the continuum, the hardest constraints are those constraints for which a violation represents a physically impossible situation, e.g., violation of a time fence. Hard constraints can be modeled by, for example, freezing a certain task on the schedule. Additionally, the hardness or softness of a constraint can be modeled by associating a relatively large weight with a hard constraint and a relatively small weight with a soft constraint.

As indicated in the above-quoted section of Applicants' specification, all resource constraints can be classified along a continuum of "soft" to "hard" resource constraints. In other words, a reusable resource constraint may be a hard or soft constraint. Similarly, a consumable resource constraint may be a hard or soft constraint. As is apparent, the classifications of

constraints as consumable or reusable resource constraints, and as hard or soft resource constraints are not equivalent. Thus, as indicated above, any teaching of Syswerda regarding hard and soft resource constraints is inapposite with respect to the question of whether Syswerda teaches or suggests the use of consumable and/or reusable resource constraints. In fact, as explained in the previous Office Action response, Syswerda does not teach the use of consumable resource constraints (see, e.g., page 9 of the previous Office Action response).

Regarding Applicants' contention in the previous Office Action response that neither Syswerda nor Tanaka teaches scheduling an activity that uses consumable resources, the Examiner also stated:

Regarding the assertion that Tanaka does not teach the use of consumable resources, the applicant supplies [an] example (page 9 of the response) of power consumption used by the factory as reusable resource. The Examiner asserts that power is generally considered a consumable resource which may be replenished like any consumable resource.

Whether or not it is true "that power is generally considered a consumable resource which may be replenished like any consumable resource," as stated by the Examiner, the power consumption constraint  $C_3$ , discussed by Tanaka at column 4, lines 8-9, i.e., "[t]otal power consumption of the entire factory at each given time must not exceed 500 kW," is not a consumable resource constraint, but a reusable resource constraint. As discussed in Applicants' specification (see, e.g., page 3, lines 25-31; page 9, lines 8-10; and page 11, lines 3-5), consumable resource constraints are inventory constraints, while

reusable resource constraints are capacity constraints. The power consumption constraint  $C_3$ , discussed by Tanaka does not state that a specified amount of power must be provided at any particular time (i.e., is not an inventory constraint), but, rather, that no more than a specified amount of power can be provided at any time (i.e., is a capacity constraint). While it may be the case that a power consumption constraint can be formulated as an inventory (i.e., consumable resource) constraint, the power consumption constraint  $C_3$  discussed by Tanaka is formulated as a capacity (i.e., reusable resource) constraint.

Regarding Applicants' contention in the previous Office Action response that the constraint relaxation taught by Tanaka is not the same as the constraint violation repair performed by Applicants' invention, the Examiner further stated:

Regarding the applicant's second issue (page 12 of the response), the applicant argues that the constraint relaxation method of Tanaka is not the same as the constraint repair method as claimed. When examining the claims, the Examiner is required to give the claims "the broadest reasonable interpretation consistent with the specification." *In re Prater*, 1396, 415 F.D. 1393, 1405, 162 USPQ 541, 551 (1969). In the instant case, the claims call for repairing constraint violations. As stated by the applicant on page 12 of the response, constraint repair "generally" does not widen a solution space as constraint relaxation does. However, as the statement implies, on occasion, a constraint violation may be repaired by constraint relaxation. Therefore, giving the claims the broadest reasonable interpretation, constraint violations may be repaired by constraint relaxation and the claims as presently drafted read upon Tanaka.

As amended, Claim 1 recites "repairing one or more constraint violations of [a] current schedule by modifying the

current schedule without relaxing [a] set of pre-defined constraints" (emphasis added). Similarly, as amended, Claim 12 recites "[a] processing device is capable of repairing one or more constraint violations for each schedule by modifying the schedule without relaxing [a] set of pre-defined constraints" (emphasis added). Likewise, as amended, Claim 20 recites "instructions for repairing one or more constraint violations of [a] current schedule by modifying the current schedule without relaxing [a] set of pre-defined constraints" (emphasis added). Tanaka teaches at column 1, lines 32-34 that "constraints can be relaxed to widen a 'solution space' or 'a set of candidate solutions'." Tanaka does not teach or suggest "repairing one or more constraint violations [of a] schedule by modifying the [schedule] without relaxing [a] set of pre-defined constraints," as recited in Applicants' claims.

For the foregoing reasons, Claims 1, 12 and 20 are allowable over the teaching of Syswerda and Tanaka, either alone or in combination. Further, since Claims 2-11 and 19 each depend on Claim 1, and Claims 13-18 each depend on Claim 12, Claims 2-11 and 13-19 are each allowable over the combination of Syswerda and Tanaka for at least the reasons given above with respect to Claims 1 and 12.

In view of the foregoing, it is requested that the rejection of Claims 1-20 under 35 U.S.C. § 103 be withdrawn.

CONCLUSION

Claims 1-20 were pending. Claims 1-20 were rejected. Claims 1, 12 and 20 have been amended. In view of the foregoing, it is requested that Claims 1-20 be allowed. If the Examiner wishes to discuss any aspect of this application, the Examiner is invited to telephone Applicants' undersigned attorney at (408) 945-9912.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231, on December 6, 1999.

12-6-99 David R. Graham  
Date Signature

Respectfully submitted,

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